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PLANT GEOGRAPHY OF YU-LUNG SNOW MOUNTAIN

- COMMUNIST CHINA -

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PLANT GEOGRAPHY OF YU-LUNG SNOW MOUNTAIN

[This is a translation of an article written by Ch'iu Lien-ch'ing and Chin Chen-chou, appearing in Ti-li Chih-shih (Geographic Knowledge), No 11, November 1958, pages 484-487.]

I. Grand Natural Landscape

About 20 kilometers to the northwest of the city of Li-chiang, a majestic high mountain is located, snow covering its top throughout the year. This is the famous Yu-lung Shan.

This mountain is the main peak of the Yun-ling Range, a branch of the Heng-tuan Mountain system. Located at $20^{\circ}10'$ - $27^{\circ}40'$ N, and $100^{\circ}10'$ - $100^{\circ}20'$ E, this mountain is made up of 12 parallel ranges with a general north-south direction. Its northwest slope connects with the Chin-sha Chiang, and is opposite the Ha-pa Snow Mountain in Chung-tien. Its southern slope rises abruptly on the north of Li-chiang Plain. The chief peak is Shan-tzu-tou, which has the absolute elevation of approximately 6,000 meters above sea level. The relative elevation is also high, being 4,200 meters above the water surface of the Chin-sha River (1,800 meters) on its west, and 3,300 meters above the Hsueh-sung Village (2,700 meters) at its west, and 3,300 meters above the Hsueh-sung Village (2,700 meters) at its southern foothills. The topography of this mountain is thus majestic indeed.

The geological structure of Yu-lung Shan is not very complicated. The main rocks are Carboniferous and Cretaceous limestones which were deep sea sediments accumulated on the bottom of the ancient geocyncline to a thickness of 3,000 meters. These rocks are called the Great Snow Mountain limestone or the Yu-lung limestone. During the mesozoic era, these sedimentary rocks were metamorphosed by the violent mountain movement. On the eastern and western side

of this mountain the structure of the rocks shows a fault scarp. The limestones have metamorphosed into Ta-li marbles. On the southern slope of the Great Snow Mountain, limestones are gradually disappearing because the beds dip southward and are therefore covered by Carboniferous limestone and basalt. Still further south, the carboniferous basalt lies right on top of the Great Snow Mountain limestone, while above this basalt lies the Tertiary rocks.

The high Yu-lung Shan resulted from the violent upwarping of the earth's crust due to recent mountain movement. Glaciation in this mountain region was well developed. From the bottom to the top of the mountain one can see clearly the terminal moraines, U-shaped glacial troughs, ciques, and matterhorns. Those features are the results of Li-chiang and Ta-li glaciations in the Quaternary period. The permanent snow at the mountain top has formed the present glaciers.

On the eastern slope of Shan-tzu-tou, the front of the ice lobe reaches down to approximately 3,800 meters in elevation. Glaciation is the major factor complicating the topography of Yu-lung Shan. At various elevations numerous small basins of different sizes are located, among which the most common are the frozen basins of the hanging valleys, such as Ma-i-pa, Kan-ho-pa, Kan-hai-tzu, etc. These basins are at present the major grazing lands in this high mountain region.

Except for the chief peak of Shan-tzu-tou, no mountain peak in Yu-lung Shan is covered by snow in summer season at present time. Therefore, every year after the melting of the snow at the end of spring, the rocks, having no vegetation, are completely exposed to the high atmosphere. In addition, the ice condenses and melts every year, and earthquakes frequently occur in the area. All these processes have intensified the process of physical weathering of the rocks. Rocks on mountain tops often crack into large or small pieces of pebbles which creep downward on the steeper slopes. Year after year, at the bottom of the mountain slopes, rock wastes accumulate as large rocky hills called talus slopes (the local people call it So-sha).

The largest talus slopes may reach 100 meters or more in width and 300 meters or more in length. The angle of the surface of the talus slope is called the angle of repose. When men stand on the slope, the balance of the angle is

upset and pebbles start creeping downslope; and men will then follow the pebbles slipping down. This kind of large size talus slope is a very unusual phenomenon of Yu-lung Shan. Also there is a special type of natural vegetation growing on this slope.

Because of the high elevation and complex topography, all types of climate, soils, fauna and flora in Yu-lung Shan have a systematic vertical distribution. The vertical distribution of climate and soils from the bottom to the top of Yu-lung Shan may be classified into the following five types.

(1) Warm winter dry climate: This type of climate prevails in the region of the Li-chiang Plain, and at the bottom of the southern slope of Yu-lung Shan. According to climatic records for the past five years at Li-chiang the annual temperature is 12.79°C . July is the warmest month with an average mean temperature of 17.9°C , while the coldest month is January with a mean temperature of 5.9°C . Annual temperature range is 12°C . If summer is defined as having a monthly temperature of 22°C or higher, Li-chiang has practically no summer season. From November to April, it is winter season in Li-chiang with the monthly temperature below 10°C . The average temperature in winter however, only falls to -0.8°C . Thus the climate of Li-chiang is characterized by a cool summer and a mild winter.

The annual precipitation amounts to 93 mm, while the annual evaporation accounts for 1,794.9 mm. Rainfall is concentrated during the period between June and October with its maximum occurring in July and August. The amount of precipitation received in these five months accounts for 90 percent of total annual precipitation. These five months are thus the rainy season. The precipitation in the rest of the year falls too far below the amount necessary to meet the evaporation.

Therefore, the climate in this region shows very clearly a rainy season and a dry season in a year. Soils in the plain are mainly under cultivation. In the mountain foot-hills, soils developed under herbaceous vegetation are chestnut, while that developed under forests is red podzolic.

(2) Humid cold climate: From 3,100 meters to 4,000 meters in the mountain waist, the annual average temperature is between 8°C - 0°C . The growing season here is shorter and relative humidity is higher. Areas above 3,100 meters

are constantly covered by clouds and fogs. According to the natives, one should not talk loudly in the fog and cloud there, lest the air would be disturbed and drizzling rainfall might be caused. Thus one can see how high the relative humidity is.

In the forests above 3,100 meters high, there are many clusters of the parasite gray pine dodder on most of the trees. The natives call these "Shu-hu-tzu." The pine dodders are plants of the genus *Cuscuta* and grow in very damp regions. The existence of the pine dodders testifies to the constant dampness of this region.

In June the mountain peak of Yu-lung Shan usually stands above the clouds and fogs, and exhibits its glittering, snow-covered peak. A belt of cloud remains on the mountain waist. This phenomenon is one of the twelve beautiful sceneries, the "cloud belt in June." From these facts we may recognize the line of 3,100 meters to be approximately the condensation height in the summer season in Yu-lung Shan. Above this line, up to 4,000 meters high, the climate is of humid and cold type. Soils may be classified into mountain grassland, chestnut, and podzolic.

(3) Tundra climate: This belt is located between 4,000 and 5,000 meters. The air temperature is again lower with annual average temperature below 0°C. The period of snow cover is comparatively longer. Radiation is intensive and wind velocity very high. Talus slopes occupy a very large area in this region. Soils are of alpine meadow.

(4) High ice desert climate: The summer snow line in Yu-lung Shan is around 5,000 meters above sea level. From this line upward to the mountain top, there are no plants growing, and all area is covered by snow.

(5) Dry steppe climate: The canyon region of the Chinsha River on the north-western slope of the mountain shows a rapid decrease on elevation (1,800 meters). Föhn wind is active. In the valley the high temperature and meager rainfall make the dry steppe climate. Vegetation cover here is quite similar to the savanna in tropical or sub-tropical regions.

II. Plant Geography on Yu-Lung Shan

The vegetation cover on Yu-lung Shan shows a clear vertical zonal distribution. Below the line of summer clouds (3,100 meters) the climate is warm and dry. *Pinus yunnanensis* forests cover most of the area. Above the line of summer clouds and below the tree line (about 3,950 meters), the climate is cold and humid. The main forests in order of increasing elevation are *Picea* forest, *Lorix potaninii* forest, and *Abeis* forest. In the area above the tree line the climate is colder and is more subject to the influence of strong winds and snow. The major vegetation groups include high mountain *Rhododendron* shrubs, *Cobresia* grasses of the high mountain type, and high mountain-rocky-cold desert vegetation.

Below is a simple introduction to the above mentioned main types of vegetation groups which are representative of the regional landscape.

1. *Pinus Yunnanensis* Forests.

Pinus yunnanensis is a type of drought resistant tree. Its growth requires abundant sunshine. It is distributed from the mountain base (2,600 meters) up to 3,200 meters in elevation, and occupies a large area. Generally speaking, it is always found on mountain ridges or mountain slopes in areas of basalt or limestone. It can grow even on steep slopes or in very barren soils. Therefore *Pinus yunnanensis* forest has the widest distribution and occupies the largest area of the lower region of Yu-lung Shan.

This forest consists of almost a single species of trees, i.e., the *Pinus yunnanensis*, which is widely distributed throughout central Yunnan Province. Above 3,200 meters, the dominance of *Pinus yunnanensis* transfers gradually to that of *Pinus densata*. The transition is, however, not very noticeable. *Pinus yunnanensis* forests consist of almost pure stands of the same age. From nursery forest to young forest, to mature forests, different stages of development are evident. The nature forest has generally a height of 10-12 meters. The top of the forest is a uniform canopy below which a lower level of shrubs and herbaceous vegetation can be seen.

Among the shrubs, the common species include *Lyonia ovalifolia*, *Rhododendron racemosum*, *Vaccinium fragile*, *Quercus monimotricha*, etc. There are many species of herbaceous vegetation; most of them are drought resistant and grow best in sunshine. In areas of shrub and grass vegetation groups, the ground is usually dry and there is plenty of sunshine coming through to the ground because of constant lumbering and grazing. Bryophytic plants are thus rather unusual in this region.

In some localities, as a result of different environmental conditions, there are many groups of trees other than *Pinus yunnanensis* trees. In the area near Hsueh-sung Village, for example, because of the favorable moisture and soil conditions there are *Pinus amandii* mixed with *Pinus yunnanensis* on the gentle slopes. Some localities of this region even have pure *Pinus amandii* forest. In the area around the Lung-wang Miao [temple], small patches of broad leaf forests exist because of protection by man. Shrubs of chestnut, oak and grass, etc., are found in a few small, damaged patches.

2. *Picea* Forest

Picea forests are distributed in the region above that of *Pinus yunnanensis* forests with a general elevation of 3,100 meters to 3,350 meters. Climate in this area is generally cool and humid. Soils are deep. *Picea* forest will develop to its best under conditions of gentle slope and plenty of moisture. Although this forest is not as widely distributed as the Yun-nan Pines are, there are many areas of mature *Picea* forests in good condition on Yu-lung Mountain. Those mature forests make up the special landscape at the mountain's waist.

The superior species of this forest is the *Picea likiangensis* which makes up the upper stratum of the forest and has a general height of 20-25 meters. The trunks of the trees stand upright with a beautiful shape. The canopy of this forest is uniform and graceful. Within this stratum there are some *Abeis forestii* (*A. georgei*), *Larix Potaninii*, *Salix delavayana*, etc. The density of the tree forest is high, covering 70-80 percent of the ground.

The shrub strata have a general height of 3-4 meters, among which *Sinarundinaria* sp. is the major species. Some of the broad leaf shrubs are : *Ribes monpinense*, var. *triparlitum*,

a variety of *Lonicera*; the small, leathery leafed *Sorbus reducta*; and various kinds of *Berbesis* spp. The herbaceous stratum is rather thin, with most specimens living in the shaded areas. Below the herbaceous strata, there exists a thick layer of bryophytic vegetation of which the *Actinothuidium Hookeri* is very common. In short, the strata of the *Picea* forest are clearly shown.

Sinarundinaria and mosses can be seen almost everywhere in this forest. The inner part of the forest is dark and damp; here the tree trunks and foliage are densely distributed. All kinds of bryophytic vegetation, especially the *Usnea longissima*, attracts special attention. This kind of vegetation is generally seen in the forests on the mountain waist of Yu-lung Shan, but is not commonly seen in the Yun-nan Pine forest on the lower mountain slopes.

3. *Larix Potaninii* Forest

Larix Potaninii forest has a limited distribution on Yu-lung Shan; at the present time only on the back slope of the mountain at an elevation of 3,300-3,550 meters, does this type of tree form a forest. In other areas of the mountain only individual stands of *Larix Potaninii* is found from place to place. In the vertical belts of forest distribution, *Larix Potaninii* is located above *Picea* forest. It looks like a narrow green band when viewed from a distance because of the elegant green color of its top. This green band of *Larix Potaninii* forest frequently extend between the *Picea* and *Abeis* forests in some places depending on the topography.

The environmental conditions for this forest are similar to those of *Picea* forest except for the slope being steeper and soils thinner. *Larix Potaninii* trees occupy an absolutely superior position in this forest, and thus make up the upper stratum of the trees. The top of the forest is not uniform. The height of the trees is approximately 10-20 meters. A small number of *Abeis forrestii*, *Picea*, *Salix delavayana*, *Acer forrestii*, *Betula albo-sinensis*, *Prunus* spp., etc., stand in the same stratum.

The shrubs include *Sinarundinaria*, *Rhododendron siderophyllum*, *Viburnum corylifolium*, *Sorbus* spp., *Lonicera* spp., *Rosa* spp., *Ribes* spp., *Spiraea lichiangensis*, etc. Below the shrubs lie a herbaceous stratum and a layer of bryophytic.

Possibly because of constant firing or lumbering in the past, the common *Larix Potaninii* forest today is mostly at its young stage. There is much light coming through the forests to the ground, and many *Sinarundinaria* species grow with the trees.

4. Abeis Forest

Abeis forests are distributed between *Picea* and *Larix Potaninii* forests on the front slope of the mountain. The Abeis forests are directly distributed above the *Pinus yunnanensis* because the *Picea* forests and *Larix Potaninii* forests have been seriously damaged. Generally speaking, Abeis forests may appear anywhere under a cool and humid climate above the cloud line of Yu-lung Shan. Intermixed with the Abeis forest, there are *Tsuga yunnanensis*, *Salix delavayana*, *Acer forrestii*, *Acanthopanax evodifolius*, *Betula Delavayivar forrestii*, etc. Except for the *Tsuga* and Abeis, which are tall, all other trees are not very high.

The higher the elevation the fewer are the species of tall trees. As a result, in the high region of Yu-lung Shan pure Abeis forests cover a large area. The highest distribution of the Abeis forests may reach 3,850 meters, while individual Abeis trees may be distributed as high as 3,950-4,000 meters. At this elevation, however, the Abeis already becomes abnormal in shape and grows mixed with shrubs. Therefore the so-called tree line is but the uppermost line of Abeis trees. At the present time the Abeis forests are mostly virgin forests. The general height of the stands of Abeis forests is about 15-20 meters. The shape of the trees is magnificent and straight. The formation of the forest is pure and clear. The forests occupy large areas above the cloud line.

All these facts contribute much beautiful scenery to Yu-lung Shan. The inner structure of the forest is also simple. Shrubs are few in number and small in size. *Sinarundinaria* species are only occasionally found, in the marginal areas of the forests or in the decayed forest areas. From nursery trees to tall stands, the Abeis trees can be seen everywhere in this region. This phenomenon illustrates the tendency toward good development of the Abeis forest. In short, between the cloud line and the tree line in Yu-lung Shan, the forest which makes up the basis landscape of the region is the Abeis forest with its dark green forest crest.

5. High Mountain Rhododendron Group

There is no tree forest existing above the tree line. Here plants become particularly short. The higher the altitude, the more difficult are the environmental conditions and the stronger the influence of wind and snow. Therefore, immediately above the Abeis forest, a shrub forest appears, dominated by Rhododendron. This kind of high mountain shrub is mainly distributed in the depressions or leeward areas of the high mountain grass land. Under different local environmental conditions, there are different types of Rhododendron, some of which are even different in their appearances.

Three types of the Rhododendron are very common and cover a comparatively wide area, namely *Rhododendron adenotyrum* and *R. Traillianum*, and *Rhododendron cephalanthum*. The last of these is distributed in even higher regions, and the plant is shorter and smaller. This kind of plant covers the ground closely like a sheet of carpet and is commonly seen on the lower slopes and at the marginal area of the talus slopes.

The common characteristics of the above mentioned Rhododendron are: (a) the plants are small and short; (b) they cover ground closely; (c) each plant has many branches; (d) the branches are soft and tough; (e) the leaves have hairs and other kinds of wind and cold prevention structures.

The landscape of this region is obviously different from the tree forest areas. One fact worthy to be pointed out here is that in Spring all kinds of Rhododendrons are in full blossom. Different patches of these shrubs present a variety of fresh and beautiful colors which enrich the white snow, making wonderful scenery.

6. *Cobresia* spp. Group in Grass Land of High Mountains

In the region above the tree line, the high mountain Rhododendron actually occupies a small portion of the land, while most of the region is covered by the common types of high mountain grass of which the Cobresia is the major species. This region may thus be called high mountain grassland of *Cobresia* spp. Its distribution is mainly above the belt of Rhododendron shrubs, and is generally in the area between 3,800-4,200 meters. This group of vegetation is made up of

short and swampy high mountain herbaceous plants.

Among these plants, *Cobresia* spp. occupies the superior and outstanding position. The root system of this type of vegetation is very well developed and the plants grow in bunches or clusters on the ground. The dense clusters of the grass make up a soft grass carpet. Around the *Cobresia* area, some of the species have beautiful big blossoms. In the growing season this grassland thus shows a colorful landscape. Of course, compared with the grass lands amid forests in the area below 2,800 meters, the colorful landscape here is inferior. The typical grassland plants of this region are *Veratilla*, *Boillonii*, *Allium victoriale*, *Cremanthodium Helianthus*, *Anemone* sp., *Aster likiangensis*, *Meconopsis venusta*, *Pedicularis* spp., *Gentiana* spp., *Leontopodium* spp., *Sedum* spp., etc.

7. Cold Rocky Desert Group in High Mountains

The grasslands in high mountains become smaller and smaller in size as one goes upward till one reaches the area of at about 4,200 meters where grassland is only found in local depressions or leeward localities. Above this line, rocky wastes and talus slopes are the major landscape, and very little vegetation cover exists. The talus slopes are the special landscape feature of Yu-lung Shan. Some of these slopes extend down to 3,700 meters. In talus slopes located below 4,000 meters vegetation cannot take root because of the constantly moving rocks and pebbles.

However, we still can see some individual plants scattered among these slopes. This kind of vegetation is a type of high mountain plant with special abilities enabling it to adapt to the environment. Thus the group of high mountain cold desert vegetation is formed. Those plants are very short and small and closely attached to the surface of the rocks.

Some of the plants have a layer of fine hairs on their bodies, for example, *Saussurea leucoma*, *Saussurea eriocephylla*, *Crepis umbella*, *Leontopodium* sp., *Potanitilla* sp., etc. Some plants of a miniature size grow together and form a sort of vegetation carpet. These include *Saxifraga montana*, *Sedum oreades*, *Androsace* sp., etc. The underground root systems of some of the plants are very well developed and have different forms. The main root system usually has a length of three to five times that of the body of the plant above the ground.

This group of plants includes, for example, *Meconopsis lancifolia*, *Saussurea* spp., *Sedum fasitigiatum*, etc. In addition, there are some plants with hair root systems, such as *Cremanthodium* spp., *Saxifraga* spp., etc. Some plants have underground fish-scale-shaped roots deeply buried below the pebbles, such as *Corydalis* sp., *Loxostemon Dilavayi*, *Carex atrofusca*, *Ephedra geradiana* var. *wallichii*, *Polystichum lichiangense*, *Sorolepidium Duthiei*, etc. All these special physiological characteristics are the results of the adaptation of the plants to their particular environment.

8. Shrub and Grass Land in the Gorges of the Chin-sha River

Chin-sha Gorge is located on the northwestern slope of Yu-lung Shan with an elevation of approximately 1,800 meters. Its climate is dry and hot. The vegetation cover is mainly grass with sparsely distributed shrubs. Scattered grey-green short shrubs with hairs on the body of the plant grow among the darker colored grass. The landscape here is thus monotonous and dry.

The common species of shrubs include *Vitex negundo*, *Trema levigata*, *Mallotus nepalensis*, *Cotinus nana*, *Terminilia Franchettii*, *Bauhinia Faberi* var. *microphylla* and *B. Faberi* var. *megaphylla*, *Osteomeles Schweinae*, etc. Herbaceous plants commonly include *Capillipedium parviflorum*, *Cymbopogon distans*, *Eremopogon Delavayi*, *Dichanthium annulatum*, *Heteropogon contortus*, *Aristida triesta*, *Themeda Hookeri*, *Bracharia villosa*, *Chloris virgata*, etc.

Due to the varieties of vegetation groups and many species of plants, the vegetation resources on Yu-lung Shan are very rich. The utilization of the vegetation resources of this region may be classified into three categories:

(1) Development of forest industry.

Both *Pinus yunnanensis* forests and *Abeis* forests cover a large area and their natural growth is under good conditions. If these forests are under further good management, they can be made to grow faster. From the Pines resin can be extracted. *Abeis* trees are good raw material for manufacturing high grade papers, though the wood is too soft for good construction material. Furthermore, the *Abeis* trees grow very fast and under good management would provide

an infinite supply. Among the different forest groups one thing that should deserve special attention by the forestry management is how to enlarge the *Picea* forests. This wood is good for making instruments and airplanes. In addition, other types of trees such as *Tsuga*, *Larix potaninii*, *Quercus semicarpifolia*, etc., all are good woods.

(2) Development of grazing industry in high mountain region above the tree line.

In the U-shaped glacial trough and at the mountain base there are many large alluvial fans on which dense herbaceous vegetation groups are growing. Those areas are good natural grazing bases. At the present time, however, some grass lands already bear signs of overgrazing; and how to develop a reasonable grazing program is an important problem.

(3) Promote the cultivation of herbal medicine in the high mountain regions

Yu-lung Shan produces many kinds of valuable medical herbs, such as Pei-mu [*Fritillaria vericillata*, var. *Thunbergii*], Ch'ung-ts'ao [lit., insect grass], Tang-ts'an [lit., party consultation or participation (in the modern sense of tang), but is also a place name in Shansi, to the northeast of Lu-ch'eng Hsien], Tang-kuei [*Ligusticum acutilobum*], etc. These herbs can be planted in large areas, and their qualities should be improved.

The study of Yu-lung Shan has not only practical value but also the scientific meaning. It can help us understand the formation and development of the southwestern mountains of our country, the problems of regional classification of natural vegetation, and the evolution and renewal of the coniferous forests in high mountains.

The solution of these scientific problems will, at the same time, provide the result that the Chinese people, understanding the natural laws governing mountain resources, will be able to utilize them more effectively.

Cold Desert
Climatic Zone

6000 M

Permanent Snow
Covered Region

Summer Snow Line

Tundra
Climatic Zone

5000 M

Talus Slope
Vegetation

4500 M

Alpine Meadow
Soils

4300 M

Alpine
Meadow

4100 M

Coniferous
Forests

3900 M

Alpine
Meadow

3700 M

Podzols

3500 M

Coniferous
Forests

3300 M

Coniferous
Forests

Vertical Distribution of Physical Environmental
Conditions on Yu-lung Shan

Cool and Humid
Climatic Zone

5000 M

4500 M

4300 M

4100 M

3900 M

3700 M

3500 M

3300 M

3100 M

2900 M

2700 M

2500 M

2400 M

Coniferous
Forests

- END -

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